(54) Title: A METHOD AND DEVICE FOR TRANSMITTING SIGNALS
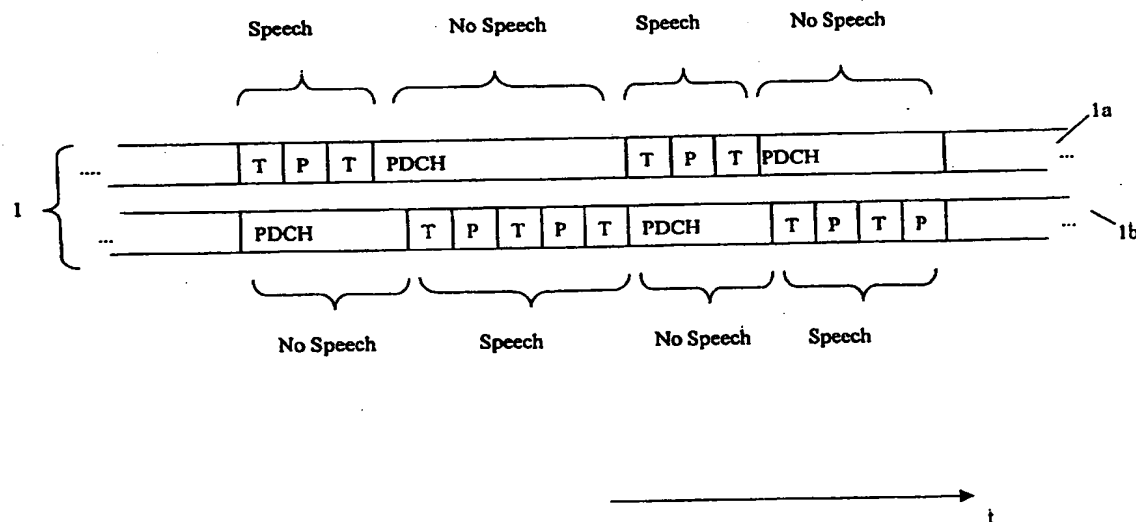
(57) Abstract: A method and device for transmitting signals of a first category and signals of a second category over a link, said link providing a predetermined signal transmission rate, where said signals of the first category have a discontinuous characteristic comprising periods of activity and periods of inactivity, where a first channel is provided for carrying signals of the first category and a second channel is provided for carrying signals of the second category, and where the two channels each have respective proportions of the predetermined signal transmission rate of the link during periods of activity of the signals of the first category, and the proportion of the signal transmission rate assigned to the second channel during periods of inactivity of the signals of the first category is increased with respect to the period of activity.

WO 02/13471 A1

A method and device for transmitting signals

[Field of the Invention]

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The present invention relates to a method and device for transmitting signals of a first category and signals of a second category over a link in a telecommunication system, where said link provides a predetermined signal transmission
10   rate, and where the signals of the first category are associated with a real-time transmission and have a discontinuous characteristic according to which these signals of the first category comprise periods of activity and periods of inactivity. An example of such signals of the
15   first category is speech, and an example of such signals of the second category is data.

[Background of the Invention]

20   In modern communications systems, there exists the situation where it is desirable to transmit signals of two different categories over a link having a predetermined signal transmission rate, i.e. a dedicated or circuit-switched link, and where the first category is prioritized with respect to
25   the second category. An example of this is the simultaneous or parallel transmission of speech and data over a dedicated link, e.g. in a mobile telephone that is capable of transmitting data together with speech, where speech basically has priority over the data transmission, and the
30   data transmission is conducted at best effort. "Best effort" is a transmission category in which there are basically no minimum assurances of band-width, and the corresponding transmission is only conducted as best as possible.

35   The above situation will e.g. occur in a mobile station of a mobile communication system, where only one (physical) channel is available, this one channel e.g. being defined by one time-slot and providing a predetermined signal

transmission rate, and where this channel should be primarily
used for carrying speech information, but it is at the same
time desired to transmit data in the background at best
effort. This is the case in such mobile communications

5   systems, in which it is desired to add data transmission
capabilities to systems that were basically designed for
speech communication, as this is presently the case for
systems that develop the GSM system further in this respect,
such as GERAN (GSM/EDGE Radio Access Network; EDGE = Enhanced

10   Data rates for GSM Evolution).

In connection with speech transmissions, it is known that the
periods of speech inactivity can be used advantageously, e.g.
to reduce the sending power of a mobile device, in order to

15   save energy. This is also known as discontinuous transmission
(DTX). In connection with the simultaneous transmission of
speech and data, it is therefore imaginable to define a first
channel for carrying speech signals and a second channel for
carrying data signals, where the first channel uses the

20   transmission rate of the provided link during periods of
speech activity, and the second channel uses the transmission
rate during periods of speech inactivity.

Although such a concept would have the advantage that the

25   periods of speech inactivity are advantageously used to
transmit data, there occurs a specific disadvantage when the
data is transported under the control of a protocol that
employs acknowledgment messages for acknowledging the correct
receipt of data. The RLC (Radio Link Control) protocol is an

30   example. This shall be explained in connection with Fig. 2.

Fig. 2 schematically shows a bi-directional link 1 that has
an up-link direction 1a and a down-link direction 1b. These
two link directions will typically show a series of speech

35   activity periods and speech inactivity periods, where it may
be remarked that these periods will usually alternate between
the up-link and down-link directions, due to the nature of
verbal exchange between two partners in a conversation. As
indicated in Fig. 2, during periods of speech activity, a

traffic channel (TCH) is assigned the data transmission rate
of the link, in order to transmit speech. On the other hand,
when there is no speech activity, then the given signal
transmission rate of the link 1 is assigned to a packet data

5   channel (PDCH), over which data packets are sent in one
direction, and over which acknowledgment messages related to
said data packets are sent in the other direction. The
concept of ARQ (Automatic Retransmission reQuest) and
acknowledgment messages is well known in the art and need not

10   be explained further here.

Under the conditions shown in Fig. 2, the alternating nature
of the channel occupation in the up-link and down-link
directions can lead to severe stalling problems for data

15   transmission, when sliding-window flow control is used.
Sliding-window flow control is again well known in the art,
and need not be explained in detail. In sliding-window flow
control, the number of packets that is sent depends on the
number of outstanding acknowledgments for packets previously

20   sent. In the situation of Fig. 2, if in the direction in
which data packets are being sent a period of speech
inactivity is very long (which corresponds to a long period
of speech activity in the other link direction), then,
although data packets could be sent, the flow control will

25   stall, as no acknowledgments can be sent.

As a consequence, the DTX concept leads to the
disadvantageous situation that the data transmission in the
periods of speech inactivity can become stalled, which means

30   that the data transmission is inefficient and of lesser
quality than could be obtained on the basis of the actual
data transmission rate available during the periods of speech
inactivity. In other words, this means that the available
band-width during periods of speech inactivity is not

35   efficiently used.

One possible solution to this problem could consist in
stealing frames from the TCH for transporting acknowledgment
messages. However, this does not lead to a satisfactory

transmission, as the known speech codecs only allow a very
low rate of stolen frames, because otherwise the speech
quality is considerably degraded. As a consequence, stolen
frames do not provide sufficient transmission capacity for
5 sending acknowledgment messages.

Another solution that may be envisaged is the introduction of
a Dual Transfer Mode (DTM), in which the available signal
transmission capacity is simply continuously assigned to both
10 the first and second channel. This is schematically shown in
Fig. 3. "T" represents the TCH and "P" represents the PDCH.
In a TDMA example, as in GSM, where the physical link is
provided by a time slot, the channel assignment shown in Fig.
3 could be realized by giving the even numbered time slots to
15 TCH and the odd numbered time slots to PDCH. This in other
words means that the traffic channel TCH would be reduced to
half-rate (which will also be referred to as TCH/H), where
the other half of the transmission rate is assigned to the
PDCH.
20

Due to the constant provision of a certain amount of band-
width for the PDCH in both directions, the stall conditions
mentioned in connection with the DTX concept do not occur. On
the other hand, similar to the situation for the DTX concept,
25 there is a waste of transmission capacity during periods of
speech inactivity, as a traffic channel for carrying speech
is assigned that uses one half of the band-width, although
there is no speech to be transmitted in these periods of
inactivity.
30

As a consequence, both of the above-discussed concepts,
namely DTX in connection with Fig. 2 and DTM in connection
with Fig. 3, suffer from the disadvantage that the
transmission during periods of speech inactivity becomes
35 inefficient. It may be noted that this problem is not
restricted to the above-described example of the simultaneous
transmission of speech and data, but will occur in any system
that desires to transmit a first and second category of
signals over link having a predetermined transmission rate,

where the first category has a discontinuous characteristic comprising periods of activity and periods of inactivity. Besides real-time speech information, this could e.g. also be real-time video information. Also, the signals of the second category do not have to be data as such, but could be any type of information that is suitable for best effort transmission at a lower priority than the first category of signals.

[Object of the Invention]

The object of the invention is to provide an improved method and device for transmitting signals of a first category and a second category over a link having a predetermined signal transmission rate, where the signals of the first category have a discontinuous characteristic, such that the above-described problems can be overcome and an efficient transmission can be obtained during periods of inactivity of the signals of the first category.

[Summary of the Invention]

This object is solved by the method described in claim 1 and the communication device described in claim 12. Advantageous embodiments are described in the dependent claims.

In accordance with the present invention, a first proportion of the signal transmission rate provided by the link is assigned to the first channel and a second proportion is assigned to the second channel during periods of activity of the first category of signals. In other words, during such periods of activity of the signals of the first category, the transmission rate of the link is shared by the two channels. On the other hand, during periods of inactivity, the proportion assigned to the second channel (which carries signals of the second category) is increased with respect to the proportion assigned during periods of activity. Preferably, the second channel receives most or all of the

transmission rate during periods of inactivity of the signals
of the first category.

This is shown schematically in Fig. 1, which again shows a
5   bi-directional link similar to Figs. 2 and 3. Also, it shows
an example where the signals of the first category are speech
signals. Also, Fig. 1 shows an example where the TCH and the
PDCH share the predetermined transmission rate equally during
periods of speech activity (i.e. TCH/H and PDCH at the same
10   rate), and where the link transmission rate is fully
allocated to the PDCH during periods of speech inactivity.

The concept of the present invention, when applied to the
situation where packets of the second category are sent in
the one link direction and feed-back packets (such as
15   acknowledgment packets) are sent in the other link direction,
as shown in the example Fig. 1, achieves the important
advantage that the transmission during periods of inactivity
of signals of the first category (speech signals in Fig. 1)
becomes highly efficient with respect to the concepts
20   described above in connection with Figs. 2 and 3. Namely, due
to the fact that a channel for signals of the second category
is provided during periods of activity of the signal of the
first category, there is no stalling, because acknowledgment
messages can always be sent. In other words, there is no
25   waste of band-width during periods of signal inactivity of
signals of the first category due to stalling. Moreover, the
periods of inactivity of the signals of the first category
are used more efficiently for the second channel in
comparison to the example of Fig. 3 (DTM), as the channel
30   assignment for the second channel (PDCH) is increased, and
preferably increased to the highest amount possible.

This highest amount can be 100%, such that there is no signal
35   transmission over the first channel (TCH) during periods of
inactivity of the first signal. According to a preferred
embodiment, in which the signals of the first category are
real-time speech signals, the first channel is only used for
a transmission of background noise during periods of speech

inactivity, where the proportion of the signal transmission rate of the link used by the first channel for transmitting the background noise is lower than the proportion of the transmission rate assigned to the second channel during such
5   periods of speech inactivity. Namely, although it will then not be possible to assign 100 % of the signal transmission capacity to the second channel during the periods of speech inactivity, as a small amount of transmission capacity is required for the transmission of background noise,
10 nonetheless most of the signal transmission rate of the link (more than 90 %) can be assigned to the second channel.

It is possible that the assignment of the first and second channels is performed in principal during an associated mode,
15 regardless of the demand for data transmission. According to another preferred embodiment of the invention, the assignment of transmission capacity to the first and second channel is however only performed if there are signals of the second category to be transmitted. In other words, in the context of
20 an example in which the signals of the first category are speech and the signals of the second category are data, a sharing of the transmission rate between a first channel (TCH) and a second channel (PDCH) is only performed if there is data to be transmitted, whereas if there is no data to be
25 transmitted, then the available transmission rate is assigned fully to the first channel, i.e. the speech channel TCH.

[Brief description of figures]

30 The present invention shall be better understood from the following description of preferred embodiments, where said description refers to the accompanying figures, in which:

Fig. 1   shows a schematic example of an embodiment of the
35   present invention;

Fig. 2   shows a schematic representation for describing the concept of discontinuous transmission (DTX);

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Fig. 3   shows a schematic representation for explaining the
            concept of dual transfer mode (DTM); and

Fig. 4   shows a schematic block diagram for representing an
5   embodiment of a communication device according to
            the present invention.

[Detailed description]

10   In the following, examples of the present invention shall be
      explained in detail. The following examples presume that the
      signals of the first category are speech signals, and the
      signals of the second category are data signals. The speech
      signals are transported in frames, as this is well known e.g.
15   from GSM. The data signals are present in the form of data
      packets arranged in accordance with any suitable data
      transmission protocol, such as RLP or TCP, this transmission
      lying at a higher layer than the physical layer that handles
      the channel assignment for the first and second channels.
20
      Although this is a preferred embodiment, the present
      invention is by no means restricted thereto, as the signals
      of the first category could e.g. also be real-time video
      signals, or any other type of signal having a discontinuous
25   characteristic according to which periods of activity and
      periods of inactivity occur. Also, the signals of the second
      category can be any type of signal that should be transmitted
      at best effort parallel to the signals of the first category.

30   Furthermore, the following examples shall relate to mobile
      communication systems, as the field of mobile communications
      is a preferred application of the present invention. Namely,
      the more efficient use of band-width resources is of special
      importance in mobile communication systems, because band-
35   width is a scarce resource in such systems. However, the
      present invention is by no means restricted thereto, as it in
      principle can be applied to any communication system in which
      signals of a first category and second category as defined in

the claims are to be transmitted over a link of given transmission capacity.

Furthermore, the following examples shall assume that the link is physically defined by way of a time-slot in a TDMA scheme, such that said time-slot also determines the link transmission rate. However, it is clear that the link can be provided in any suitable way, namely also by a frequency (FDMA), or a code (CDMA), or by any suitable combination of such multiple access concepts.

Fig. 4 shows a schematic block diagram of a communication device according to the present invention, which here is a terminal station of a mobile communication system. Naturally, the present invention can also be implemented in any node of a communication system. The communication device comprises a data source 41, which can e.g. be some sort of data processing application, and it also comprises the basic telephone features of a speech control section 42, which especially contains a codec for coding and decoding speech, where said speech control section 42 is coupled to a microphone 44 and a loudspeaker 43. It may be remarked that other conventional features of a telephone system, such as a keyboard, a display, etc. are not shown in Fig. 4 for the purpose of simplicity.

The communication device figure 4 furthermore comprises a speech discriminator 45, which is adapted to discriminate between periods of speech activity and periods of speech inactivity ("silent" periods, in which the signal from the microphone 44 only contains background noise). The discriminator 45 can operate according to any known principle of speech discrimination as used in the known DTX systems. For example, a combination of threshold comparisons and spectral domain techniques can be employed. As this is well known in the art, it needs not be described further here.

The communication device of Fig. 4 also comprises a channel management part 46 that is arranged to on the one hand

establish channels for transmitting speech signals coming
from the speech control section 42 and on the other hand for
transmitting data signals coming from the data source 41,
over the common link 1, which is a bi-directional link as
5   shown in Fig. 1.

It may be noted that the channel management part will on the
one hand establish the channels, and on the other hand
perform the assignment of transmission rate to established
10   channels. In other words, if a channel is not established,
then no assignment can take place. The present invention is
preferably implemented in such a way that once an appropriate
operation mode is entered, e.g. as selected by the user, the
channel management part will establish the first and second
15   channel. When this mode is terminated, then the channels as
defined in accordance with the invention are also terminated.

According to a first embodiment, the communication device of
Fig. 4 is operated in such a way that the assignment of
20   transmission rate provided for the link 1 is conducted as
exemplified in Fig. 1. Namely, the channel management part 46
and the node at the other end of link 1 (e.g. a base station
sub-system BSS in the case of a GSM communication system) are
controlled such that during periods of speech activity
25   detected by discriminator 45, the transmission capacity of
link 1 is assigned to both the traffic channel TCH for
carrying speech signals and the packet data channel PDCH for
carrying data signals. It may be noted that although Fig. 1
only shows two channels, the present invention is also
30   applicable to more than two channels.

On the other hand, during periods of speech inactivity, the
proportion of transmission rate assigned to the data
transmission channel PDCH is increased with respect to the
35   proportion during speech periods. In the example of Fig.1,
the entire transmission rate is assigned to the data
transmission channel PDCH. In this case there would be no
transmission of background noise during the periods of speech
inactivity. In this case it is e.g. possible that the two

terminal stations involved in the communication are arranged
to create comfort noise during these periods of speech
inactivity. It is, however, also possible to arrange the
channel assignment during periods of speech inactivity in
5   such a way that a large portion of the transmission rate is
used by the data transmission channel PDCH, and only a small
part is used by the TCH for transmitting background noise
(e.g. > 90 % to the PDCH and < 10 % to the TCH).

10   It is in principle possible that the assignment of data
transmission rate to the speech channel TCH and the data
channel PDCH is variable during the periods of speech
activity. This depends on the specific requirements of the
individual system, and can e.g. also depend on factors such
15   as supplementary channels (i.e. the case where more than the
two channels TCH and PDCH are provided), etc. It is, however,
preferable that the assignment during periods of speech
activity is in a fixed proportion, e.g. 1/4 to the data
channel PDCH and 3/4 to the traffic channel TCH. Such a fixed
20   proportionality has the advantage of easier maintenance. More
preferably, the two channels share the data transmission rate
at 1/2 each. In other words, in the context of a GSM system,
the traffic channel becomes a half-rate traffic channel TCH/H
as is already well known for GSM half-rate systems, and the
25   other half of the transmission rate provided by the link is
assigned to the packet data channel PDCH. In other words, the
TCH/H corresponds to a half-assigned time-slot, where every
second burst is assigned, while the PDCH is equally a half-
assigned time-slot in which every other second burst is
30   assigned. On the other hand, during periods of speech
inactivity, if the whole transmission rate is assigned to the
PDCH, during these periods the PDCH is assigned every burst
to thereby fully use the time-slot.

35   It may be noted that typically the channel management part 46
will instruct the codec in speech control section 42 to
switch to lower rate coding (e.g. half-rate coding) of
speech if the concept of Fig. 1 is used.

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According to the presently described first embodiment, the
channel assignment during periods of speech activity is
performed regardless of the presence or absence of data
packets to be transmitted. The advantage is the simplicity of
5   the control scheme. Namely, if the communication device is
operated to enter a mode in which the concept of the present
invention is applied, then the channel assignment as
indicated in Fig. 1 is automatically activated. The
disadvantage is that band-width is assigned to the data
10   transmission channel, even if no data is present, such that
said band-width could be used for enhancing the speech
transmission over the traffic channel TCH.

Therefore, in accordance with a second embodiment, the
15   channel assignment as shown in Fig. 1 is only performed in
the presence of data to be transmitted. In other words, if
the data source 41 indicates to the channel managing part 46
that there is a demand for data transmission, then the
channel management part 46 performs the assignment to thereby
20   create the situation as shown in Fig. 1. On the other hand,
if there is no demand for data transmission, then the channel
management part 46 assigns the full transmission rate to the
traffic channel, i.e. assigns a TCH/F. It may be noted that
the operation during periods of speech inactivity and in the
25   absence of data packets to be transmitted can be handled in
any desired way. For example, the known DTX operation of
reducing the sending power during periods of speech
inactivity can be invoked, in order to save battery capacity,
or alternatively the packet data channel PDCH can be assigned
30   during the period of speech inactivity, such that if a demand
for data transmission appears during the period of speech
inactivity, a transmission can immediately commence.

In summary, in both the first and second embodiment, at least
35   if there is data to be transmitted, the available
transmission rate of the link is shared between the speech
channel or traffic channel TCH and the packet data channel
PDCH during periods of speech activity, and the proportion of
data transmission rate assigned to the PDCH is increased

during periods of speech inactivity. As already specified
earlier, this concept is especially advantageous in
connection with bi-directional links, in which the data
signals carried by the PDCH are in the one link direction
5 data packets, and in the other link direction feed-back
packets related to the received data packets, e.g.
acknowledgment messages in the context of an ARQ scheme.
There are numerous protocols that make use of feed-back
packets for controlling the flow of data packets, such as RLC
10 (Radio Link Control) or also TCP (Transmission Control
Protocol). Both the RLC protocol and the TCP protocol are
well known in the art and well described in corresponding
specifications, such that a further description is not
necessary here.

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It may be noted that it is of no importance how the protocol
using feed-back packets is implemented or arranged, e.g. if
the acknowledgment packets are sent automatically or if they
are only sent in response to a polling message from the data
20 packet sender.

In any case, in accordance with the present invention, there
is always a packet data channel PDCH present, even in periods
of speech activity, such that feed-back packets can always be
25 sent, such that no stalling will occur, so that the periods
of speech inactivity can be efficiently used. In other words,
the present invention provides an effect not providable by
the system described in connection with Fig. 2. Also, the
present invention provides an effect not attainable by the
30 system of Fig. 3, because in Fig. 3 there is a waste of
transmission capacity for the traffic channel in those
periods, in which there is no speech. Therefore, in summary,
the system of the present invention achieves the effect not
achievable by either the system of Fig. 2 or of Fig. 3.

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The identification of the assigned channel type by the
receiving end of link 1 can be done in any desired or
suitable way, e.g. by means of appropriate headers in frames.
In accordance with a preferred example of the present

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invention, which relates to a GSM based system that
additionally employs the definitions of GPRS (General Packet
Radio Service) for data transport, the so-called stealing
bits of the physical layer frame are used for identifying the
5   assigned channel. This can be used in the up-link as well as
the down-link direction. The stealing bits are starting bits
provided by a burst that are not coded together with the
payload. For example, the first two bits are not coded with
the payload. Over the course of several bursts such stealing
10   bits code information about the content of these bursts. For
example, in GPRS four bursts form one radio block, such that
eight stealing bits are available for indicating which coding
for the payload has been used.

15   An example of how the two channels and the corresponding data
transmission rate can be assigned will now be described. The
transmitter is arranged such that each link direction
transports a series of frames, where RLC PDUs (PDU = Protocol
Data Unit) and voice frames alternate. The RLC PDUs carry
20   data. The voice frames carry speech during periods of speech
activity, and carry data during periods of speech inactivity,
to thereby achieve the concept shown in Fig. 1. In other
words, the channel management part simply places data into
the voice frames during periods of speech inactivity, and
25   changes the stolen bit(s) in the voice frame, such that the
receiver will correctly identify the frame as carrying data.

On the other hand, in the above mentioned second embodiment,
it is possible that during periods of speech activity in
30   which no data is to be transported, the channel management
part will place voice signals into the RLC PDUs, and also
accordingly set the stolen bit(s), such that the receiver may
correctly identify the payload of the PDU.

35   In such a combined GSM/GPRS system, the traffic channel TCH
will not only carry the speech signals, but also the other
known associated virtual channels for transporting control
information, such as the FACCH (Fast Associated Control
Channel), the SACCH (Slow Associated Control Channel), etc.

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and the data packet channel PDCH will also carry the known associated GPRS virtual channels, such as the PACCH (Packet Associated Control Channel).

5   With respect to the above-mentioned preferred example of a GSM/GPRS system, it may be noted that although GPRS is oriented towards packet-switching (i.e. connectionless), the situation underlying the present invention is such that a link with a predetermined data transmission rate is present,
10 i.e. a dedicated circuit-switched link. For this reason, even if data is being sent in accordance with protocols and standards established in connection with GPRS, then specific simplifications can be employed. Namely, in GPRS a so-called temporary block flow (TBF) is assigned every time that data
15 is to be sent. This is due to the connectionless concept underlying GPRS. The TBF includes assigned resources (such as a time-slot) as well as established RLC entities. Due to the fact that in the situation underlying the present invention the data is being sent over a circuit-switched link, it is
20 not necessary to generate a TBF for every data transmission. Much rather, it is sufficient to establish a virtual TBF (which could also be referred to as a "permanent" TBF) when the combined channel consisting of a TCH and a PDCH is established, and this virtual TBF shall only be terminated
25 when the combined channel is released, namely when the communication switches to a mode in which the concept of the present invention is not used.

Although the present application has been described in the
30 context of specific examples, these examples are only intended to provide the skilled person with a better understanding and are not intended to restrict the scope of the invention. The scope of the invention is much rather defined by the appended claims. Also, reference signs in the
35 claims only serve the purpose of better understanding and do not restrict the scope.

[Claims]

1.   A method of transmitting signals of a first category and
5   signals of a second category over a link (1) in a
      telecommunication system, said link providing a
      predetermined signal transmission rate, where said
      signals of the first category are associated with a
      real-time transmission and have a discontinuous
10   characteristic according to which said signals of said
      first category comprise periods of activity and periods
      of inactivity, said method comprising:

      providing a first channel (TCH) for carrying signals of
15   said first category and providing a second channel
      (PDCH) for carrying signals of said second category,

      assigning a first proportion of said predetermined
      signal transmission rate to said first channel (TCH) and
20   a second proportion of said predetermined signal
      transmission rate to said second channel (PDCH) during
      periods of activity of said signals of said first
      category, and

25   increasing the proportion of said predetermined signal
      transmission rate assigned to said second channel (PDCH)
      during periods of inactivity of said signals of said
      first category.

30 2.   The method of claim 1, wherein during periods of
      activity of said signals of said first category the
      first and second channel each use a fixed proportion of
      the predetermined signal transmission rate.

35 3.   The method of claim 2, wherein during periods of
      activity of said signals of said first category the
      first and second channel each use a one half of the
      predetermined signal transmission rate.

4. The method of one of claims 1 to 3, wherein said signals of said first category are real-time speech signals.

5. The method of claim 4, wherein during periods of speech inactivity said first channel is only used for a transmission of background noise, where the proportion of said predetermined signal transmission rate used by said first channel for transmitting background noise during periods of speech inactivity is lower than the proportion of said predetermined signal transmission rate used by said second channel.

6. The method of one of claims 1 to 3, wherein said signals of said first category are real-time video signals.

7. The method of one of claims 1 to 6, wherein said signals of said second category are non-real-time data packets sent from a first end of said link to a second end, and acknowledgment packets for acknowledging the correct receipt of a data packet, said acknowledgment packets being sent from said second end to said first end.

8. The method of one of claims 1 to 7, wherein said link is established between a terminal station and a node of said telecommunication system.

9. The method of claim 8, wherein said telecommunication system is a mobile communication system and said terminal station is a mobile station.

10. The method of one of claims 1 to 9, wherein said step of assigning first and second proportions of said predetermined signal transmission rate to said first channel (TCH) and said second channel (PDCH) during periods of activity of said signals of said first category is only invoked if there are signals of said second category present that are to be transmitted, such that in the absence of signals of said second category to be transmitted and during periods of activity of said

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signals of said first category said predetermined signal
transmission rate is assigned fully to said first
channel (TCH).

5   11. - The method of claim 1, wherein said link is a bi-
directional link having a first direction and a second
direction, said signals of said second category consist
of data packets to be sent in the first direction and
acknowledgment packets to be sent in the second
10   direction, and said first and second channels are
provided at least in said second direction.

12.   A communication device, said communication device being
operable to transmit signals of a first category and
15   signals of a second category over a link in a
telecommunication system, said link providing a
predetermined signal transmission rate, where said
signals of the first category are associated with a
real-time transmission and have a discontinuous
20   characteristic according to which said signals of said
first category comprise periods of activity and periods
of inactivity, said communication device comprising:

a channel establishment part (46) arranged to provide a
25   first channel (TCH) for carrying signals of said first
category and a second channel (PDCH) for carrying
signals of said second category,

a discriminator (45) for discriminating between periods
30   of activity and periods of inactivity of said signals of
said first category, and

a channel management part (46) arranged to communicate
with said discriminator, said channel management part
35   being operable to assign a first proportion of said
predetermined signal transmission rate to said first
channel (TCH) and a second proportion of said
predetermined signal transmission rate to said second
channel (PDCH) during periods of activity of said

signals of said first category indicated by said speech discriminator, and to increase the proportion of said predetermined signal transmission rate assigned to said second channel (PDCH) during periods of inactivity of said signals of said first category indicated by said speech discriminator.

13. The communication device of claim 13, wherein said channel management part is arranged such that during periods of activity of said signals of said first category the first and second channel each use a fixed proportion of the predetermined signal transmission rate.

14. The communication device of claim 13, wherein said channel management part is arranged such that during periods of activity of said signals of said first category the first and second channel each use one half of the predetermined signal transmission rate.

15. The communication device of one of claims 12 to 14, wherein said signals of said first category are real-time speech signals.

16. The communication device of claim 15, wherein said channel management part is arranged such that during periods of speech inactivity said first channel is only used for a transmission of background noise, where the proportion of said predetermined signal transmission rate assigned to said first channel for transmitting background noise during periods of speech inactivity is lower than the proportion of said predetermined signal transmission rate assigned to said second channel.

17. The communication device of one of claims 12 to 14, wherein said signals of said first category are real-time video signals.

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18. The communication device of one of claims 12 to 17,
wherein said signals of said second category are non-
real-time data packets sent by said communication device
over said link, or acknowledgment packets for

5   acknowledging the correct receipt of a data packet
received by said communication device over said link.

19. The communication device of one of claims 12 to 18,
wherein said communication device is a terminal station

10 of said telecommunication system.

20. The communication device of claim 19, wherein said
telecommunication system is a mobile communication
system and said terminal station is a mobile station.

15
21. The communication device of one of claims 12 to 20,
wherein said channel management part is arranged such
that said assigning of first and second proportions of
said predetermined signal transmission rate to said

20 first channel (TCH) and said second channel (PDCH)
during periods of activity of said signals of said first
category is only conducted if there are signals of said
second category present that are to be transmitted, such
that in the absence of signals of said second category

25 to be transmitted and during periods of activity of said
signals of said first category said predetermined signal
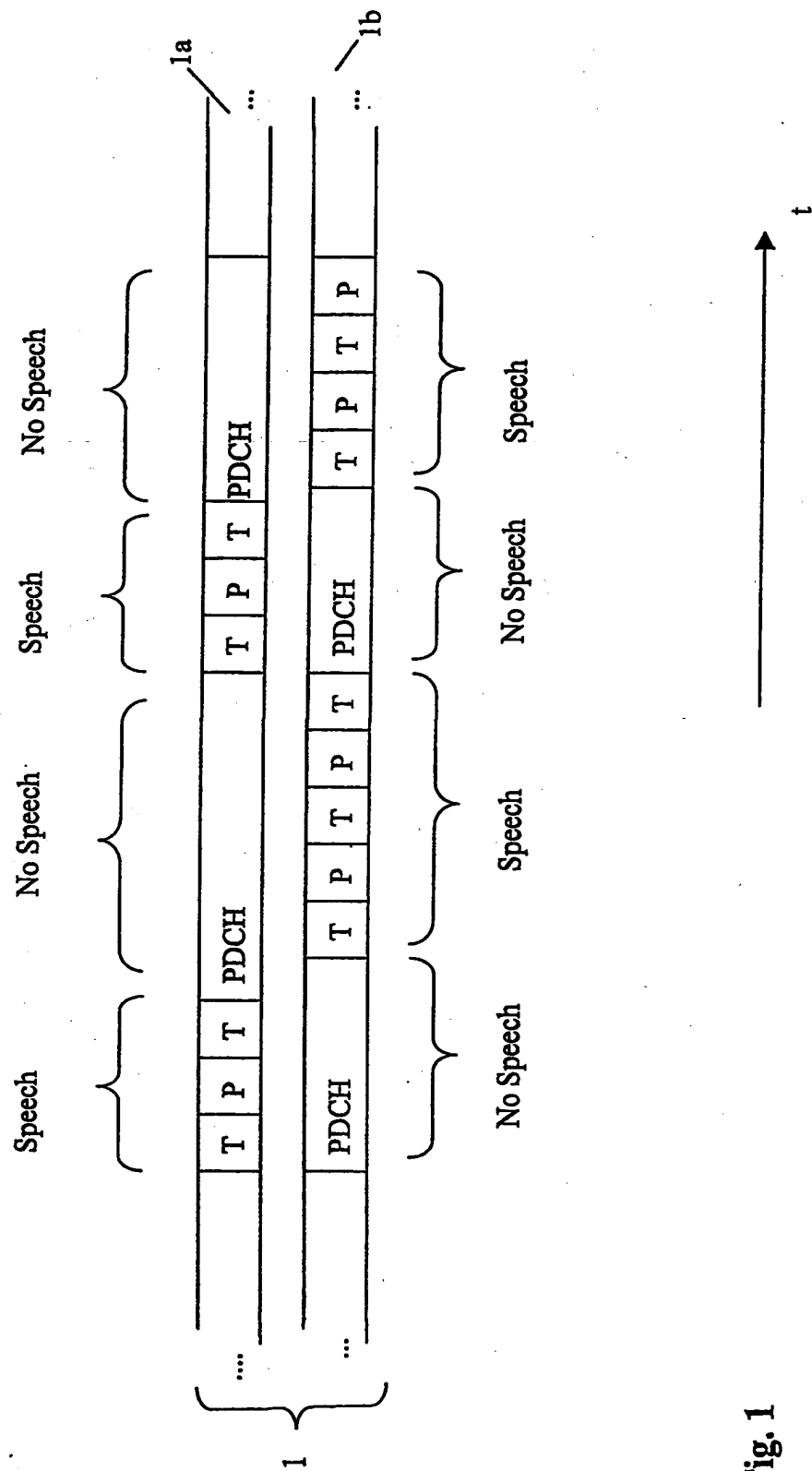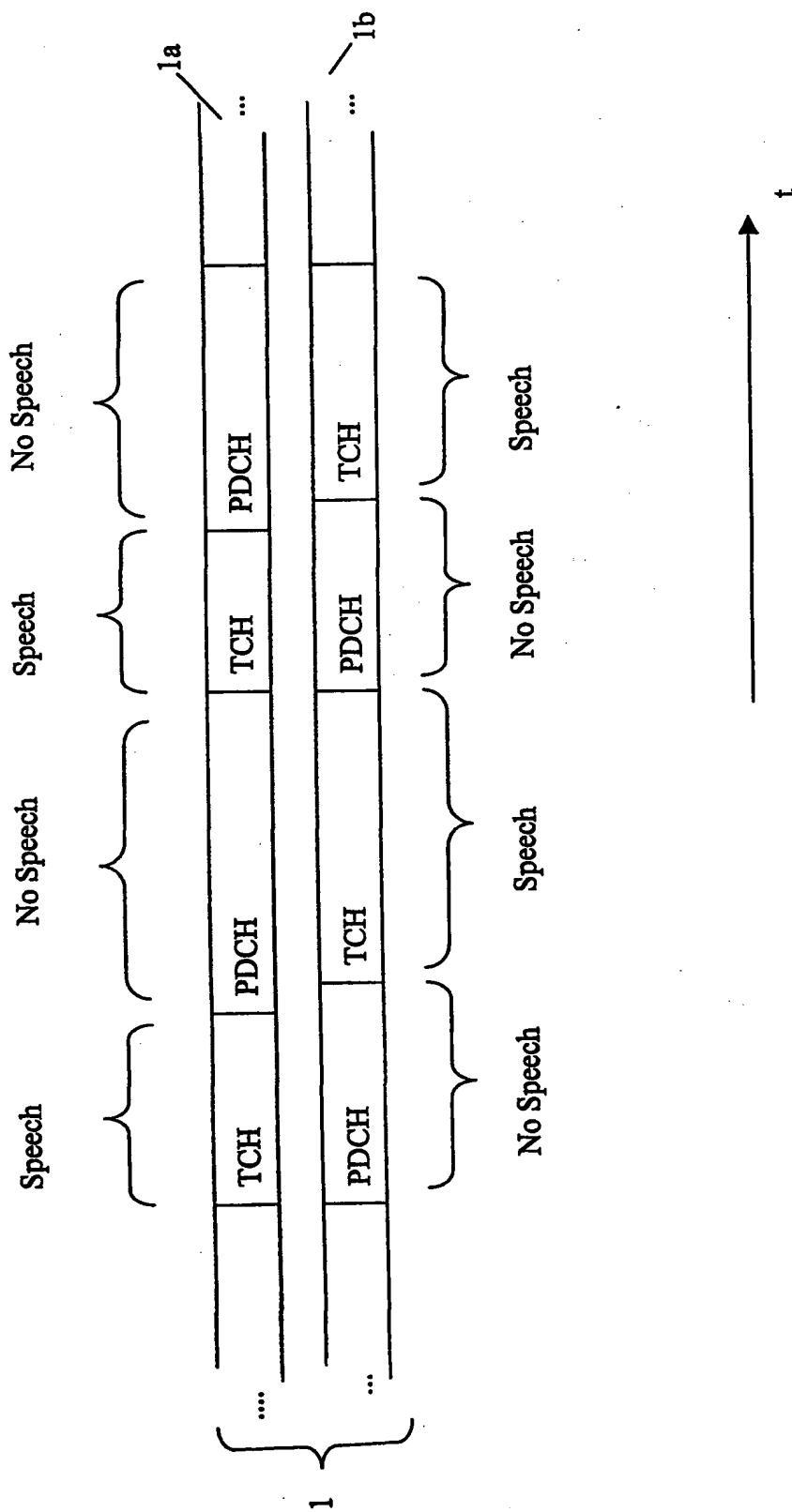transmission rate is assigned fully to said first
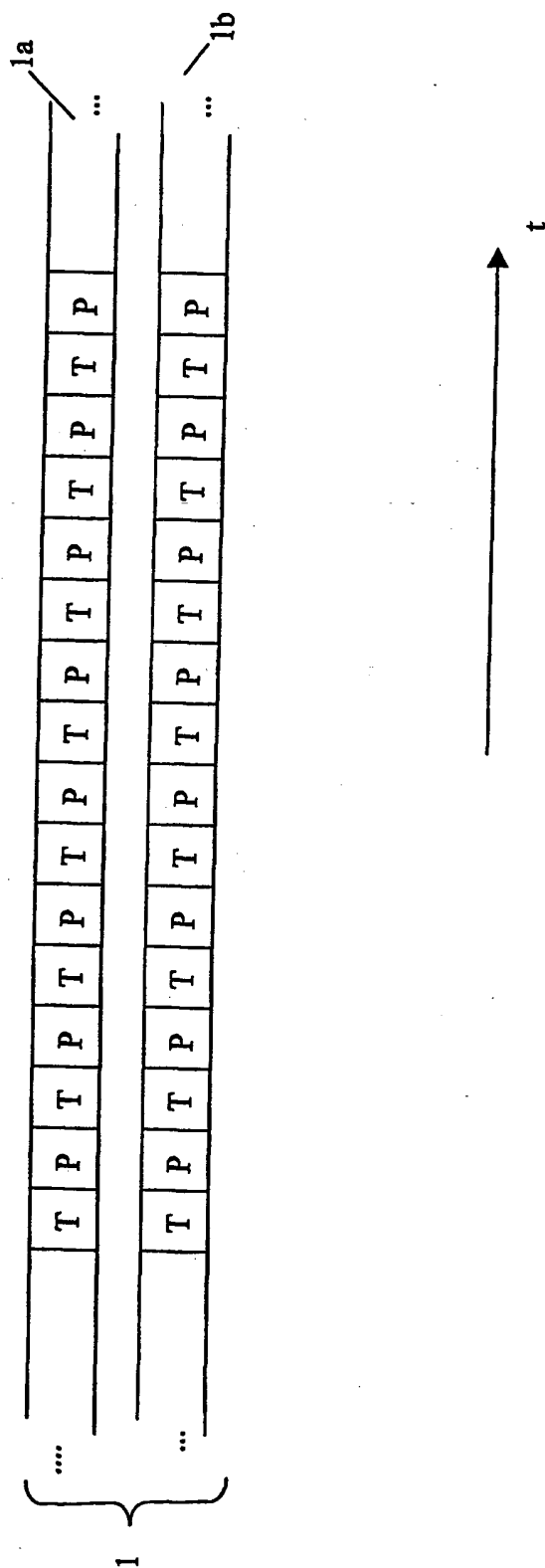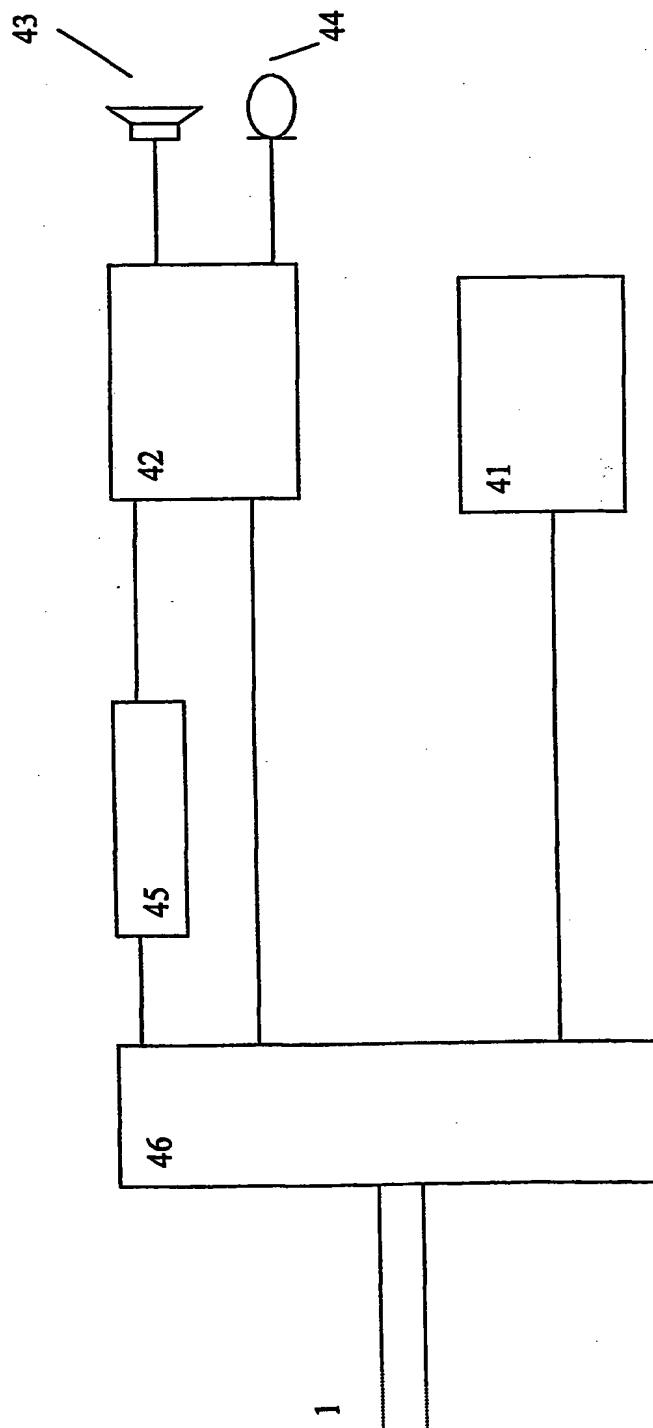channel (TCH).

30

Fig. 1

Fig. 2

Fig. 3

Fig. 4

INTERNATIONAL SEARCH REPORT

A. CLASSIFICATION OF SUBJECT MATTER

IPC 7   H04L12/64

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7   H04L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5 757 801 A (ARIMILLI HARINARAYANA) 26 May 1998 (1998-05-26)	1,4,5,7, 8,10-12, 15,16, 18,19,21
A	abstract figures 3,4A-1,5A column 3, line 1 – line 22 column 7, line 10 – line 17 column 12, line 32 – line 40 column 17, line 6 – line 30 column 24, line 1 –column 26, line 16 column 28, line 30 –column 30, line 45	9,20

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| X | Further documents are listed in the continuation of box C. | | X | Patent family members are listed in annex. |

° Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
8 November 2001	15/11/2001

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INTERNATIONAL SEARCH REPORT

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category°	Citation of document, with indication,where appropriate, of the relevant passages	Relevant to claim No.
A	TRAN H ET AL: "RANDOM ACCESS WITH MIXED VOICE AND DATA WITH INTERPOLATION OF DATA IN SPEECH" PROCEEDINGS OF THE GLOBAL TELECOMMUNICATIONS CONFERENCE (GLOBECOM),US,NEW YORK, IEEE, vol. -, 29 November 1993 (1993-11-29), pages 113-117, XP000428416 abstract page 113, column 1, paragraph I page 113, paragraph II.A -page 114	1,12
A	BOCCI P ET AL: "DYNAMIC DATA PACKET SIZING BASED ON REAL TIME MONITORING OF SYSTEM VOICE ACTIVITY" MOTOROLA TECHNICAL DEVELOPMENTS,US,MOTOROLA INC. SCHAUMBURG, ILLINOIS, vol. 31, 1 June 1997 (1997-06-01), page 172 XP000741064 entire doc	9,20

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